ENVS Example Environmental Analysis Paper

The Industrialization of Food and the Deterioration of America's Waterways

In the wake of World War II, the industrialization of America's food supply got underway. While it played a significant role in the growth of the nation, the consequences have only recently come into view. Among those consequences are unsafe levels of nitrate in the water supply consumed by humans and in the waterways which are the key cogs in many ecosystems and give life to an abundance of animal species. This paper will examine the circumstances which have created the problem, describe the effects of elevated nitrate levels in our water, and explore solutions to the crisis.

A history lesson is imperative to understand how this problem developed. As Michael Pollan documents in *The Omnivore's Dilemma*[1], large stocks of ammonium nitrate that was utilized in bomb making were left over at the conclusion of World War II. At which point someone realized that since crops need nitrogen in the soil to survive and grow, all those leftovers could be put to use. And so in 1947 the munitions plant in Muscle Shoals, Alabama became a fertilizer plant. The discovery of synthetic nitrogen early in the 20th century for the purposes of more effectively blowing things up then became the catalyst for agriculture's move away from diversity in which different crops supported the viability of other and toward corn, corn, and more corn. Unwilling to risk any sub-optimal crop yield, farmers spread much more fertilizer than necessary, and the excess runs off into our waterways.

The negative effects of elevated nitrate levels in the water supply impact humans as well as wildlife. A study published in a 1996 issue of the *European Journal of Epidemiology* found heightened risk of certain cancers from consumption of nitrate polluted water for people living in the Valencia region of Spain[2]. The elevated risk of stomach cancer in men and women, as well as for prostate cancer in men was established. Elevated risk of bladder and colon cancer is suspected, but not scientifically established. The risks for these cancers may be even greater in most populations than for the people of

Valencia, because the main crop of the region is citrus. Therefore the population consumes more citrus which contains ascorbic acid which is believed to reduce cancer risk. A population not consuming so much citrus on average may be even more susceptible to developing cancer due to consumption of water with higher than acceptable nitrate levels.

It logically follows that if unnatural nitrate levels in water are bad for humans, they are probably bad for wildlife as well. This does appear to be the case. A 1999 article published in *Environmental Health Perspectives* focuses on the effects of nitrate levels on amphibians[3]. It found that exposure nitrate levels as low as 3 mg/L for only 96 hours resulted in various species of tadpoles developing negative behaviors. These tadpoles ate less, were less active, and became emaciated and suffered high mortality rates. Among those that survived, some tadpoles suffered from deformities of their tails, heads, or digestive systems. This next concept is not taken from the article, but the lack of viability of the tadpoles could demonstrate a bottleneck effect for these species resulting in a lack of genetic diversity among the surviving tadpoles, and then of course, frogs.

Having established that nitrates in human water supply and waterways providing habitat for wildlife are potentially life threatening to people and animals alike, it is time to examine potential solutions. Rouse (et al. 1999) suggests buffer zones surrounding threatened waterways[3]. Since it is the excess fertilizer which runs off into these streams, buffers of vegetation that could employ the nitrates as they head toward the water could prevent them from making it there. These buffers may need to be only several meters in depth but could extend to several hundred meters depending on need for the region. They give an example of 19 meter deep buffer made up of mixed woodland in Maryland which reduced nitrate levels in the surrounded stream from 7 mg/L to <0.5 mg/L.

Another preventive measure, which is also put forth by Rouse (et al. 1999)[3], can actually be arrived at by anybody who employs a little critical thinking. As mentioned in the historical summary

above, it is just the excess fertilizer which runs off into waterways. A little restraint on the part of the farmers who use all of this fertilizer would go a long way. Since the largest farm operations in America are feeding at the government trough through subsidies, it should be easy for the EPA to step in and provide incentives for farmers to be more judicious with their use of fertilizer. Guidelines could easily be crafted to determine how much fertilizer per acre is necessary for a healthy crop. Farmers who do not comply with the guidelines should be denied their welfare check. Tests of soil could be conducted to check for compliance, or farms could be restricted in the amount of fertilizer they can buy in a year based on the size of their farm. Fertilizer purchases are already regulated to make sure the next Timothy McVeigh doesn't buy a large quantity for any apparent good purpose, so the infrastructure for such a program would seem to be in place.

What seemed like an ingenious solution to the problem of feeding a growing population sixty years ago has turned into a cataclysmic event for the world. The presence of billions more people on the planet than could have been supported without industrialization has spawned many global crises which will have to be reckoned with in the future. Right here and right now, it is established that nitrates in drinking water and wildlife ecosystems pose a significant threat to people and animals. Solving this won't cure all the world's ills, but small victories still count. More responsible farming practices and/or protection of affected waterways are reasonably simple fixes to the problem and should be proactively implemented before the scope of the crisis widens any further.

References

[1]Pollan, Michael. The Omnivore's Dilemma: A Natural History of Four Meals. New York: Penguin Books; 2006.

[2]Morales-Suarez-Varela MM, Llopis-Gonzalez A, Tejerizo-Perez ML. Impact of Nitrates in Drinking Water on Cancer Mortality in Valencia, Spain. *European Journal of Epidemiology*. 1995 Feb; 11(1): 15-21.

[3]Rouse JD, Bishop CA, Struger J. Nitrogen Pollution: An Assessment of Its Threat to Amphibian Survival. *Environmental Health Perspectives*. 1999 Oct; 107(10): 799-803.